# PHY 741 – Assignment #3

NAWH – September 1, 2003

The following two exercises are designed to help you get familiar with Maple. You need only turn in your maple worksheets.

1. The following integral represents the electrostatic potential due to an electron in the ground state of a hydrogen atom. The positive real constant $a$ represents the Bohr radius. Evaluate the integral using Maple and check that it makes sense.

$$4\pi\varepsilon_0 V(r) = \frac{1}{r}\int_0^r r'^2 e^{-2r'/a}\, dr' + \int_r^\infty r' e^{-2r'/a}\, dr'. \tag{1}$$

2. Find the eigenvalues and eigenvectors of the following $5 \times 5$ matrix.

$$H = \begin{pmatrix} 2 & -1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & -1 & 2 & -1 \\ 0 & 0 & 0 & -1 & 2 \end{pmatrix}. \tag{2}$$